

REMARKS

Claims 1-41 and 45-89 are pending in this application. Claims 42-44 are cancelled. New claims 90 to 98 are presented.

New independent claim 92 is similar to claim 1 prior to amendment herein but expressly recites that the pump is a reciprocating pump that is disposed within said recirculation loop for recirculating the etchant gas along the recirculation loop.

New independent claim 94 is a means-plus-function version of claim 1 after amendment.

New independent claim 97 is similar to claim 22 prior to amendment but expressly recites a step of maintaining the etchant gas in the recirculation loop at a temperature so as to keep the etchant gas in vapor form.

New independent claim 101 is an apparatus claim similar to new independent claim 92, except that claim 101 (instead of reciting a reciprocating pump) expressly recites a bellows pump disposed within the recirculation loop for recirculating the etchant gas along the recirculation loop.

New independent claim 102 is similar to claim 22 prior to amendment herein but expressly recites that the pump is a reciprocating pump by way of which the etchant gas is recirculated through the recirculation loop.

New independent claim 103 is similar to claim 26 prior to amendment but expressly recites that the pump is a reciprocating pump with which the etchant is recirculated multiple times through the etching chamber.

New independent claim 104 is similar to claim 38 prior to amendment herein but expressly recites that the pump is a reciprocating pump that is in communication with the etching chamber and adapted to pump etching gas repeatedly through the etching chamber.

New independent claim 105 is similar to claim 56 prior to amendment herein but expressly recites that the pump is a reciprocating pump that is in connection with the etching chamber and the source so as to recirculate the etchant gas through the etching chamber.

New independent claim 106 is similar to claim 26 prior to amendment herein but expressly recites a step of maintaining the etchant in the recirculation loop at a temperature so as to keep the etchant gas in vapor form.

An Office Action was mailed on September 2, 2004. In the Office Action, the examiner indicated that the Notice of Allowance mailed October 2, 2003 has been vacated. Claims 1-4, 6,

7, 10, 11, 16, 17, 22-28, 36, 38, 47-49, 51-59, 61-72, 74-75, and 77-81 were rejected under 35 U.S.C. 102(b) as being anticipated by Guilmette, US patent 4,551,197. Claims 5, 18-21, 50, and 60 were rejected under 35 U.S.C. 103(a) as being unpatentable over Guilmette. Claims 15 and 29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Guilmette in view of Winters, US patent 4,190,488. Claims 5, 12-14, 39-41, 50, and 73 were rejected under 35 U.S.C. 103(a) as being unpatentable over Guilmette in view of Davis, US patent 4,891,087. Claims 37, 82, 83, and 85-89 were rejected under 35 U.S.C. 103(a) as being unpatentable over Guilmette in view of Tai, US patent 6,162,367. And claims 8, 9, 45, 46, 76, and 84 were rejected under 35 U.S.C. 103(a) as being unpatentable over Guilmette in view of Dickson, US patent 4,910,153.

An interview between the examiner and applicants' representative Greg Muir was conducted on October 25, 2004, and is appreciated by the applicants and the representative. The substance of the interview is incorporated in the amendments made for the claims and the remarks, *infra*.

With respect to independent claim 1, claim 1 as amended expressly recites that the valve connects the source to the recirculation loop such that the etchant gas can be introduced into the recirculation loop when the valve is turned on, and the source is disconnected from the recirculation loop when the valve is shut off; and a pump that is disposed within said recirculation loop for recirculating etchant gas along said recirculation loop so as to continuously recirculating the etchant gas in the recirculation loop when the source is disconnected from the recirculation loop. The combination of these elements is not disclosed or suggested by Guilmette.

Specifically, Guilmette discloses an etching path that comprises, as shown in FIG. 2, reaction chamber 10, valve 14, cold trap 19, valve 31, storage 35, single access pipe 34, and valve 33. In operation, the etchant gas is required to be collected, condensed, and vaporized in both of cold trap 19 and storage 35. If the cold trap (19) and the storage (35) are interpreted as the source and recirculation pump recited in claim 1, the recirculation "loop" of Guilmette would not be operable. Specifically, there will be no recirculation loop in which the etchant flows in a loop when either the cold trap 19 or the storage 35 is disconnected (somehow) from the loop.

Guilmette discloses an alternative etching path that comprises reaction chamber 10,

valve 16, cold trap 21, valve 32, storage 35, single access pipe 34, and valve 33. For the same reason as discussed above for the "loop" passing through cold trap 19, this alternative "loop" is not a teaching or suggestion of the recirculation loop set forth in claim 1 as amended.

Guilmette discloses a way to recapture (and reuse) etchant, particularly etching and capturing in one "loop", followed by preparing the recaptured etchant to be reused (while etching and capturing in an alternate "loop"), but nowhere discloses the recirculation apparatus or methods as set forth in independent claim 1 (and independent claims 22, 26, 38, 47, and 56).

For the rejection to claims 5, 12-14, 39 to 41, 50, and 73 as being obvious over Guilmette and David, because claims 5 and 12-14 dependent from claim 1, they are allowable for at least the same reason for claim 1. Claims 38-41 depend from claim 38, they are allowable for at least the same reason for claim 38. Claims 50 depends from claim 47, it is allowable for at least the same reason for claim 47.

Regarding the rejection to dependent claims 37, 82, 83, and 85-89, they are allowable for at least the same reasons for claims 26 (to which claim 37 depends), claim 1 (to which claim 82 depends), claim 38 (to which claim 83 depends), claim 47 (to which claim 85 depends), claim 56 (to which claim 86 depends), claim 68 (to which claim 87 depends), claim 22 (to which claim 88 depends), and claim 26 (to which claim 889 depends).

Finally claims 8, 9, 45, 46, 76, and 84 were rejected as being obvious over Guilmette in view of Dickson and Davis. Because claims 8 and 9 depend from claim 1, they are allowable for at least the same reason for claim 1.

In rejecting independent claim 45, the examiner combines Guilmette, Davis, and Dickson and stating that "the Guilmette/Davis combination does not teach the use of bellows pump. Dickson teaches the use of bellows pump. It would have been obvious to one skilled in the art to use a bellows pump because Dickson teaches that conventional bellows pumps are for recirculation of gases." It is respectfully submit that, there is no such motivation to combine these there references for the purpose of achieving the subject matter set forth in claim 45.

First, Guilmette is directed to an etching system using condensable etchant, such as XeF_2 for etching a sample. It requires condensation and vaporization of the etchant. Davis, however, discloses a radio-frequency glow discharge plasma etch electrode for creating high power density plasma. There is no motivation to modify the etching system of Guilmette with the teachings of Davis. Second, disclosed by Dickson are deposition feedstock and dopant materials

for use in the fabrication of hydrogenated amorphous silicon alloys for photovoltaic devices and other semiconductor devices. It is non-analogous to the subject matter of etching a sample using condensable etchant in Guilmette or plasma in Davis. Therefore, combination of Dickson with Davis and Guilmette lacks reasonable motivation, especially for the purpose of achieving the subject matter set forth in claim 45.

Even forced into such combination, the combination does not teach all elements of claim 45. Moreover, such combination does not enable one skilled in the art to make and use the claimed invention in claim 45. For example, claim 45 recites a perforated plate and a baffle within the flow-through chamber. These two elements are not disclosed by Guilmette, Davis, or Dickson. Furthermore, claim 45 recites a reciprocating pump that drives the etchant gas selected from a noble gas halide and a halogen halide. In contrast, the bellows pump in Dickson recirculates the gas mixture of Airco @ CCD grade silane and Matheson @ germane. It does not teach or suggest the reciprocating pump set forth in claim 45. As far as the undersigned knows, no one has previously attempted to pass a noble gas halide or interhalogen gas etchant through such pump. Therefore, claim 45, as well as claims 46, 76, and 84 dependent from claim 45, is allowable over Guilmette, Dickson, and Davis.

New claims 92, 94, and 101-105 each expressly recite a reciprocating pump (or a bellows pump in claim 101) provided for recirculating the etchant gas that is a noble gas halide or a halogen halide in the recirculation loop. Such reciprocating pump (or bellows pump) is nowhere disclosed or suggested in Guilmette, Davis, or Dickson. In contrast, Guilmette, for example, uses cold trap 19 and storage 35 for driving the etchant in the etching path through processes of condensing and evaporation of the etchant gas. It is submitted that any of the condensing units in Guilmette are not pumps in the first place - but rather traps for collecting condensate for reuse. In any event, they are certainly no reciprocating pumps as set forth in the claims. In the invention set forth in these claims, the reciprocating pumps pass the etchant gas (and etching by-products) through the recirculation loop during recirculation of the gas (and gaseous etching by-products). The cold traps in Guilmette trap part of the gas coming from the etching chamber (anything that has a condensation point at or below the temperature of the cold trap) and releases anything that has a higher condensation temperature. Then the portion that is collected can be reused. The Guilmette cold trap is neither a reciprocating pump nor an equivalent, nor would a reciprocating pump be an obvious modification to the Guilmette

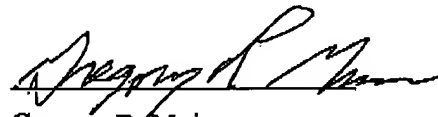
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reference. Therefore, it is respectfully submitted that claims 92, 94, and 101-105 are allowable over Guilmette. Because claims 93 depend from allowable base claim 92, and claims 95-96 depend from allowable base claim 94, they are also allowable over Guilmette.

New claims 97 and 106 each expressly recite a step of maintaining the etchant gas in the recirculation loop at a temperature so as to keep the etchant gas in vapor form. This step is neither disclosed nor suggested by Guilmette, Davis, or Dickson. In contrast, the etchant gas in Guilmette is condensed and evaporated in operation so as to cause the etchant gas flow through the etching chamber. Therefore, it is respectfully submitted that claim 97 and 106, as well as claims 98-100 that depend from claim 97, are allowable over Guilmette.

The application is considered in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. In the event any fees are required in connection with this paper, please charge our Deposit Account No. 501516.

Respectfully submitted,



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